

CLAIMS

1. An optical device having a back facet and a front facet opposite to each other, said device including:

5 - a laser adapted to emit light essentially perpendicular to said back facet;

- a modulator having an input end and an output end, respectively, and adapted to receive and modulate light emitted from said laser and to output modulated light at said modulator output end; and

10 - a window region arranged between said modulator output end and said device front facet;

- said device being further arranged such that modulated light output from said modulator is transmitted through said window region and is output from said device through said front facet, 15 wherein

- said modulator is bent such that the modulated light output from said modulator is propagating essentially in a direction, which is angled with respect to the normal of said front facet.

2. The optical device as claimed in claim 1 wherein the angle 20 between the propagation direction of the light and the normal of said front facet is at least 2°, preferably at least 5°, more preferably at least 8°, and most preferably around 8°.

3. The optical device as claimed in claim 1 wherein said modulator output end is tapered.

25 4. The optical device as claimed in claim 3 wherein the width of said modulator output end is tapered.

5. The optical device as claimed in claim 3 wherein the thickness of said modulator output end is tapered.

6. The optical device as claimed in claim 3 wherein the tapered modulator output end section is between 10 and 1000 microns long, and preferably between 20 and 50 microns long.

7. The optical device as claimed in claim 1, wherein said front 5 facet is provided with an AR coating.

8. The optical device as claimed in claim 1 wherein the device is a monolithically integrated semiconductor device.

9. The optical device as claimed in claim 1 wherein the laser is a DFB laser and the modulator is an EAM.

10. The optical device as claimed in claim 9 wherein the back facet is provided with an HR coating.

11. The optical device as claimed in claim 1 wherein the device is made of $\text{InP}/\text{In}_{1-x}\text{Ga}_x\text{As}_y\text{P}_{1-y}$.

12. The optical device as claimed in claim 1 wherein said front 15 facet is angled with respect to said back facet.

13. The optical device as claimed in claim 12 wherein the angle between the propagation direction of the light and the normal of said front facet, and the angle between said front facet and said back facet are selected such that the light transmitted through said window region and output from said device is propagating essentially in a direction, which is perpendicular to said back facet.

14. An optical module comprising the optical device as claimed in claim 1.

25 15. The optical module as claimed in claim 14 further comprising an out-coupling device arranged at an angle with respect to the normal of said optical device front facet.

16. The optical module as claimed in claim 15 wherein said angle with respect to the normal of the optical device front

facet is selected such that the light transmitted through said window region and output from said optical device is propagating essentially in a direction, which is parallel with the optical axis of said out-coupling device.

5 17. The optical module as claimed in claim 15 wherein said out-coupling device comprises a lens and/or an optical isolator.

18. An optical module comprising the optical device as claimed in claim 12, and an out-coupling device.

19. An optical device having a back facet and a front facet
10 opposite to each other, said device including:

- a laser adapted to emit light;
- a modulator having an input end and an output end, respectively, and adapted to receive and modulate light emitted from said laser and to output modulated light at said modulator output end; and
- a window region arranged between said modulator output end and said device front facet;
- said device being further arranged such that modulated light output from said modulator is transmitted through said window region and is output from said device through said device front facet, wherein
- said device is arranged such that the modulated light output from said modulator is propagating essentially in a direction, which is angled with respect to the normal of said device front facet; and
- said modulator output end is tapered.

20 20. The optical device as claimed in claim 19 wherein the angle between the propagation direction of the light and the normal of

said front facet is at least 2° , preferably at least 5° , more preferably at least 8° , and most preferably around 8° .

21. The optical device as claimed in claim 19 wherein the width of said modulator output end is tapered.

5 22. The optical device as claimed in claim 19 wherein the thickness of said modulator output end is tapered.

23. The optical device as claimed in claim 19 wherein the tapered modulator output end section is between 10 and 1000 microns long, and preferably between 20 and 50 microns long.

10 24. The optical device as claimed in claim 19 wherein said front facet is provided with an AR coating.

25. The optical device as claimed in claim 19 wherein the device is a monolithically integrated semiconductor device.

15 26. The optical device as claimed in claim 19 wherein said modulator is bent.

27. The optical device as claimed in claim 19 wherein said modulator is angled with respect to the normal of said front facet.

20 28. The optical device as claimed in claim 19 wherein said front facet is angled with respect to said back facet.

29. A method for the fabrication of an optical device comprising the steps of:

25 - providing a substrate having a back facet and a front facet opposite to each other;

- forming a laser in or on said substrate, said laser being adapted to emit light essentially perpendicular to said back facet;

- forming a modulator with an input end and an output end, respectively, in or on said substrate, said modulator being adapted to receive and modulate light emitted from said laser and to output modulated light at said modulator output end;

5 - forming a window region between said modulator output end and said device front facet such that modulated light output from said modulator can be transmitted through said window region and be output from said device through said device front facet; and

10 - forming the modulator with a bend such that the modulated light output from said modulator is propagating essentially in a direction, which is angled with respect to the normal of said device front facet.

30. A method for the fabrication of an optical device comprising the steps of:

15 - providing a substrate having a back facet and a front facet opposite to each other;

- forming a laser in or on said substrate, said laser being adapted to emit light;

20 - forming a modulator with an input end and an output end, respectively, in or on said substrate, said modulator being adapted to receive and modulate light emitted from said laser and to output modulated light at said modulator output end;

- forming a window region between said modulator output end and said device front facet such that modulated light output from said modulator can be transmitted through said window region and be output from said device through said device front facet;

25 - forming the substrate, the laser, the modulator and the window region such that the modulated light output from said modulator is propagating essentially in a direction, which is

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angled with respect to the normal of said device front facet;
and

- forming the modulator output end tapered.

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